CLAIMS

The embodiment of the invention in which an exclusive property or privilege is claimed is defined as follows:

1. A joint compound to seamlessly join multiphase objects, the compound comprising:

a) a first phase; and

b) a second phase mixed with said first phase to create a mixture, wherein said second phase is kinetically stable to said first phase.

2. The joint compound as recited in claim 1 wherein components of the first phase and components of the second phase are uniformly distributed throughout the mixture.

3. The joint compound as recited in claim 1 wherein neither phase constitutes more than 85 percent of the total volume of the mixture.

4. The joint compound as recited in claim 3 wherein the first phase comprises particles and at least 65 volume percent of the particles has a grain size of no more than 10 microns.

5. The joint compound as recited in claim 4 wherein the particles of the first phase are equiaxed about 5 microns in size and wherein a toughening agent is added to the mixture.

6. The joint compound as recited in claim 1 wherein the first phase and the second phase are selected to display specific residual stresses

7. A method for seamlessly joining objects made up of certain sized particles, the method comprising:

a) supplying a joint compound having particle sizes smaller than the certain sized particles;

b) applying the joining compound to opposing surfaces of the objects to be joined together;

c) heating the joint to a temperature below the melting point of the lowest melting point constituent of the construct; and

d) applying pressure to the objects so as to direct the surfaces toward each other to create a construct, whereby the joint compound is intermediate the opposing surfaces.

8. The method as recited in claim 7 wherein the temperature is 0.5 to 0.7 the melting temperature of the lowest melting point constituent of the construct.

9. The method as recited in claim 7 wherein the pressure is between 500 psi and 45,000 psi.

10. The method as recited in claim 7 wherein the pressure and temperature are applied at an inverse relationship to each other.

11. The method as recited in claim 7 wherein the objects are comprised of

multiphase materials selected from the group consisting of ceramics, glass ceramics, intermetallic compounds, metals, and combinations thereof.

12. The method as recited in claim 7 wherein the objects are two-phase bodies and wherein the volume percent of one phase to the other phase varies from 2 to 98.

13. The method as recited in claim 7 wherein the joint compound is applied to a thickness that is at least five times the dimension of the largest particles contained in the joint compound.

14. A method for seamlessly joining together objects made of cermet, the method comprising:

a) selecting opposing surfaces of the objects having surface finishes as defined by root-mean-square values of less than 50 microns;

b) coating the surfaces with a fluid containing a metal;

c) decomposing the metal solution so as to leave a metal residue on the surfaces; and

d) contacting the surfaces to each other for a time and at a temperature and pressure sufficient to form an irreversible bond between the objects.

15. The method as recited in claim 14 wherein the metal solution contains a metal identical to a metal contained in the objects.

16. The method as recited in claim 14 wherein the metal is Ti, or Co, or Fe, or Mn, or Zr, or Ti-alloy, or Co-alloy, or Fe-alloy, or Mn-alloy, or combinations thereof.

17. The method as recited in claim 15 wherein the fluid is a metal solution selected from the group consisting of metallic nitrates, metallic acetates,

metallic hydroxides, metallic alkoxides, colloidal suspension of metals in solvents, or combinations thereof.

18. The method as recited in claim 14 wherein the residue has a thickness of five microns or less.

19. The method as recited in claim 14 wherein the fluid contains suspended hard particles, the particles selected from the group consisting of WC, TiC, TiN, or combinations thereof.

20. The method as recited in claim 19 wherein the suspended particles are less than or equal to 2 microns in diameter.

21. The method as recited in claim 14 wherein the residue has a thickness of less than or equal to 10 microns.

22. A construct comprising a first hard crystalline solid having a first surface directly bonded to a second surface of a second crystalline solid, wherein the finish of the first surface and second surface are less than or equal to 1 micron, as defined by standard root-mean-square values.

23. The construct as recited in claim 22 wherein the first solid contains a material which represent 85 volume percent or less of the total volume of the first solid.

24. The method as recited in claim 22 wherein the second solid further comprises a crystalline solid that deforms by grain-boundary sliding.